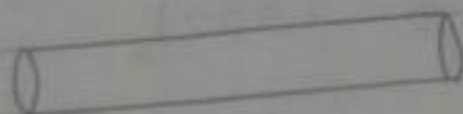
lect. (3) (1)

(-ve) numbers :-

- Signed
- (r-1) Complement
- (r) Complement.

Fractional numbers :-

- fixed point.
- floating point.

⇒ To represent numbers < 0 :
We use one bit for the sign
0 → means +ve
1 → means -ve

Signed :-
We change the sign of number -15 in binary in 8b

15	2	1
7	2	1
3	2	1
1	2	1
0		

0 0 0 0 1 1 1 1	+ve 15

in binary Signed

|1| 11

Numbers

- Signed
  - Signed
  - r Complement
  - (r-1) Complement
- un-Signed

⇒ What is (r-1) Complement

- We Simply Subtract each digit from (Base - 1)

000 1 1 1 1
| 1 111 0 0 0 0 |

- Find (r-1) Complement of $(93)_d$
(06)

$(971)_d \xrightarrow{(r-1)\text{Complement}} (028)_d$

$(345)_o \xrightarrow{(r-1)\text{Complement}} (432)_o$

- the Sum of the number and its (r-1)'s Complement

$$\begin{array}{r} 432 \\ 345 \\ \hline 777 \end{array}$$

- Find r's Complement of $(1101)_B$?

Step 1 ⇒ (r-1)'s Complement 0010

Step 2 ⇒ add 1

$$\begin{array}{r} 0010 \\ 1 \\ \hline 0011 \end{array}$$

$$\begin{array}{r} 100 - \\ 73 \\ \hline 27 \end{array}$$

1 +99 - 73 =

(r-1)'s Complement

$$\begin{array}{r} 26 + \\ 1 \\ \hline 27 \end{array}$$

26 { 9-3 = 6, 9-7 = 2

- find r's Complement of $(815)_{dec}$.

* Step 1: (r-1)'s Complement → Subtract each digit from (9) →

$$\begin{array}{r} 999 \\ 815 \\ \hline 184 \end{array}$$

* Step 2: 184 + 1 → Add (1)

$$\begin{array}{r} 184 \\ 1+ \\ \hline 185 \end{array}$$

$$\begin{array}{r} 815 \\ 185 \\ \hline 1\boxed{000} \end{array}$$

-ve 815

⇒ In Binary: We have two methods to find r's Complement

- find (r-1) Complement r's Complement then Add one (+1)
- Start from right Copy all zeros until find first one then: 0 → 1, 1 → 0

$(15)_d = (1111)_2$

r-Complement

$$\begin{array}{r} 1111 \\ 1111- \\ \hline 0000 \\ 1+ \\ \hline 0001 \end{array}$$

Add 1

$$\begin{array}{r} 1111 \\ 1 \\ \hline 1\boxed{0000} \end{array}$$

⇒ Find 2's Complementary of 20 in 8bits?

20	2	0
10	2	0
5	2	1
2	2	0
1		1

↑

$(20)_d = (10100)_B$

⇒ 2's Complement is reversible operations:

11101100

↓

00010100

20 | 0 | 0 0 1 0 1 0 0 |

-25 | 1 | 1 1 0 0 1 1 1 |

| 1 1 1 1 1 0 1 1 |

↓ 2's Complement

1 1 1 1 1 1 0 1 **-5**

* ~~take~~ We have 4 bits, Find the range of numbers in the following Cases:-

* UnSigned ⟶ (+ve only)
* Signed ⟶ (using Signed for -ve)
* Signed ⟶ (using 2's Complement)

	+ve	-ve, +ve Signed	-ve, +ve 2's comp.
0000	0	0	0
0001	1	1	1
0010	2	2	2
⋮	⋮		⋮
0111	7	7	7
1000	8	-0	-8
1001			-7
⋮			-6
⋮			⋮
1110			
1111	15	-1	-1